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Abdominal Ultrasound - Gallbladder and Biliary Tree

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Abdominal Ultrasound Gallbladder and Biliary Tree

2-6MHz curvilinear transducer

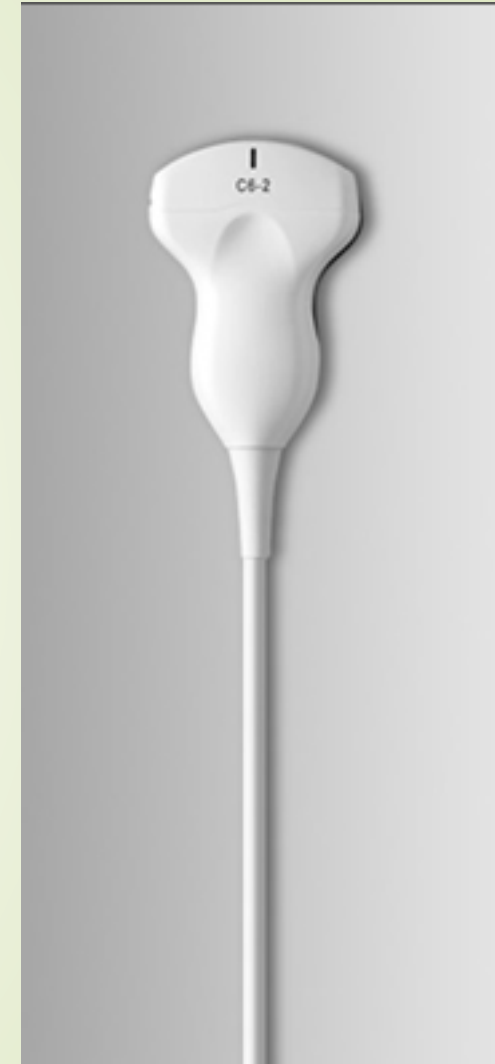
6-10MHz linear transducer for fundal gallbladder wall if it lays anteriorly and patient is thin

Depending on body habitus, it may be visible via the inter- or subcostal Left decubitus position is often helpful, multiple positions is essential for identifying small and/or elusive stones.

Assess entire organ in transverse and longitudinal

Common indicators:

- RUQ pain
- Jaundice
- Assess for gallstones



Patient clinical history and presentation is essential

Gallbladder and proximal bile ducts are often imaged through the liver, which is used as an acoustic window.

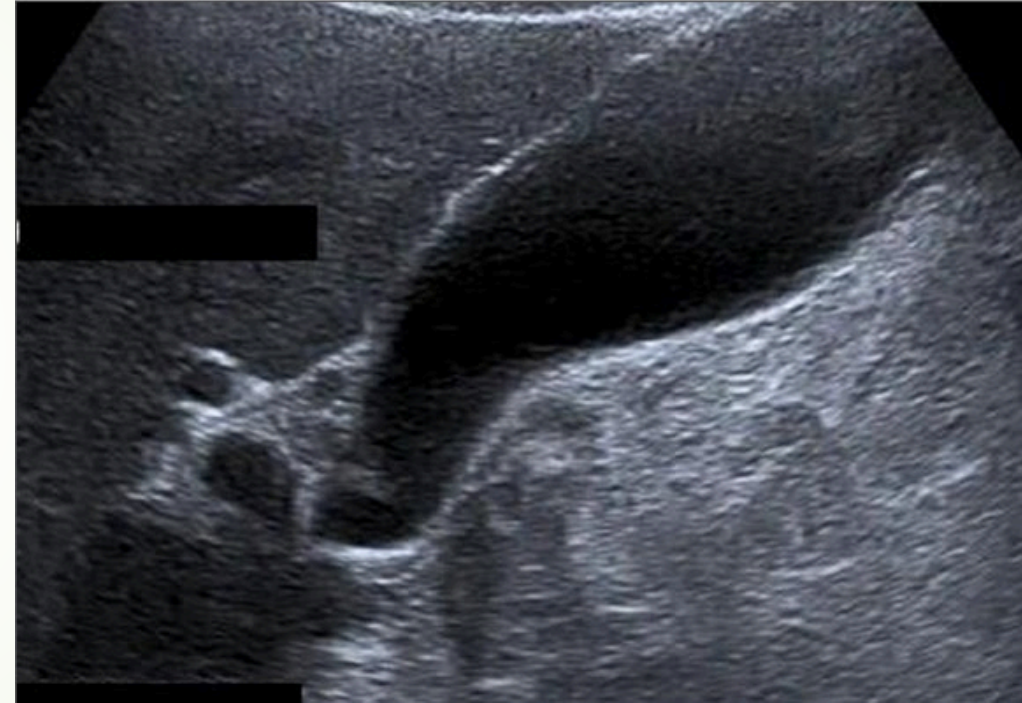
Longitudinal gallbladder and cystic duct

Transverse gallbladder



Longitudinal normal gallbladder

- elongated pear-shaped cystic structure
- anechoic
- well-delineated
- smooth thin walls less than 3mm
- adjacent to the inferior margin of the liver, between the right and left lobes.
- divided into fundus, body and neck

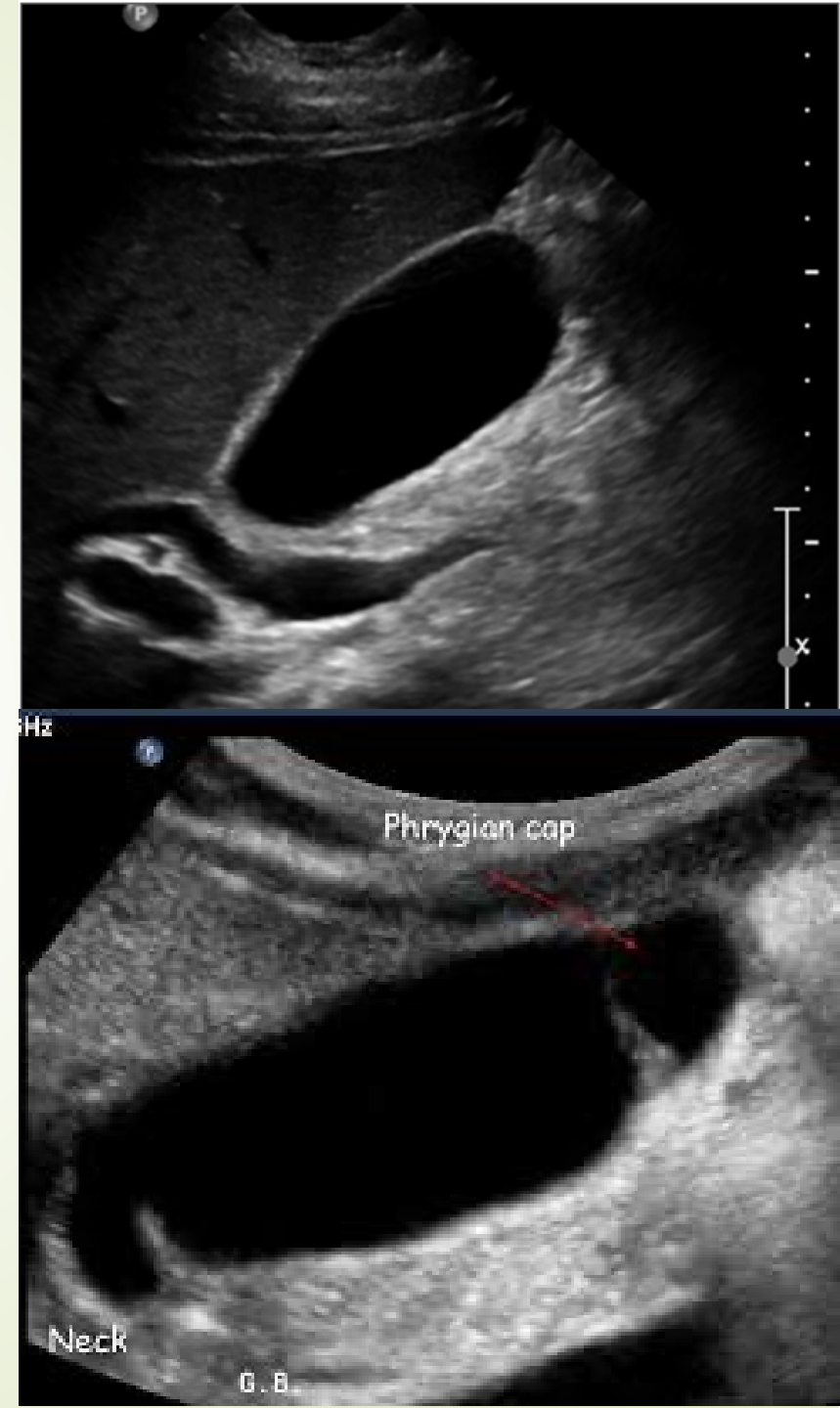


Longitudinal gallbladder fundus, wall is thin, no gallstones, neck not seen on this image

Portal vein, common hepatic duct, common bile duct and hepatic artery

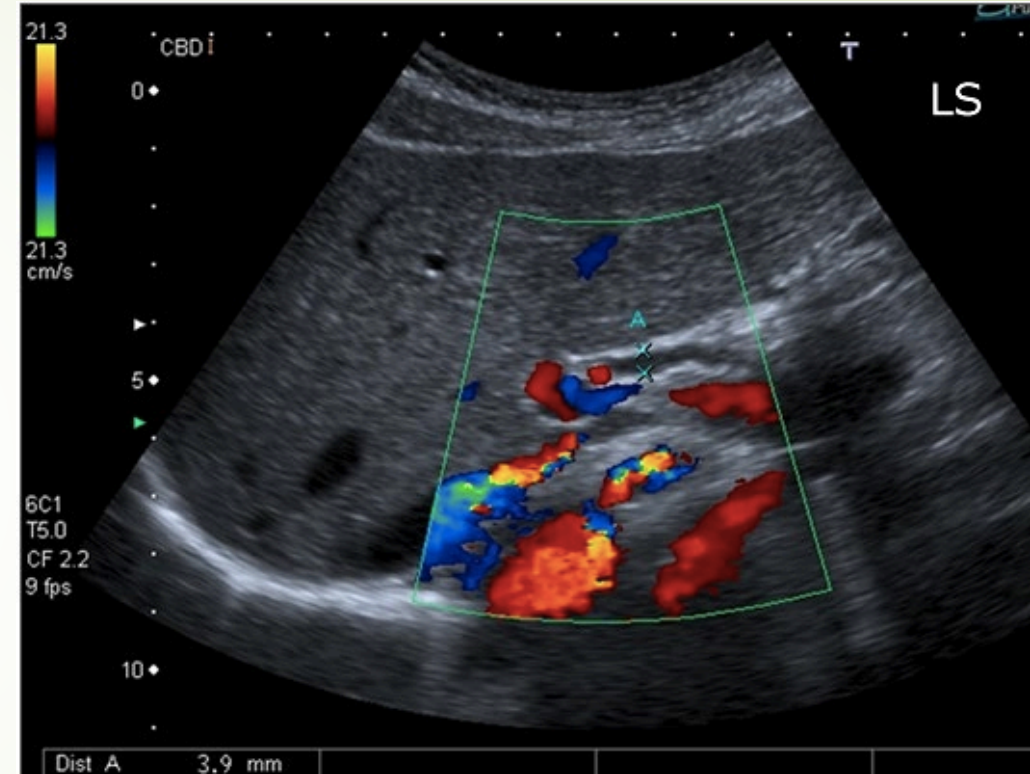
Phrygian cap is a fold in fundus often seen

Fundus is susceptible to pathology, risk is increased with history of chronic cholecystitis and/or adenomyomatosis.



The right and left hepatic bile ducts can be seen within the liver. Other ducts are seen only when there is biliary dilatation. The bile ducts lay parallel and adjacent to the portal veins and when dilated can demonstrate a double-barrel appearance.

Colour doppler can aid visualization of the bile ducts as it highlights blood vessels, such as the main portal vein and hepatic veins. The vessels without colour flow are bile ducts.



Subcostal oblique with cephalad angulation

Long section of CBD parallel to portal vein, with hepatic artery (HA) posterior to CBD. In 15% the hepatic artery lies anterior to CBD.

Normal caliber for CBD in antero-posterior (AP) is 5mm, increasing caliber with age (1mm per decade above 60 yrs old).

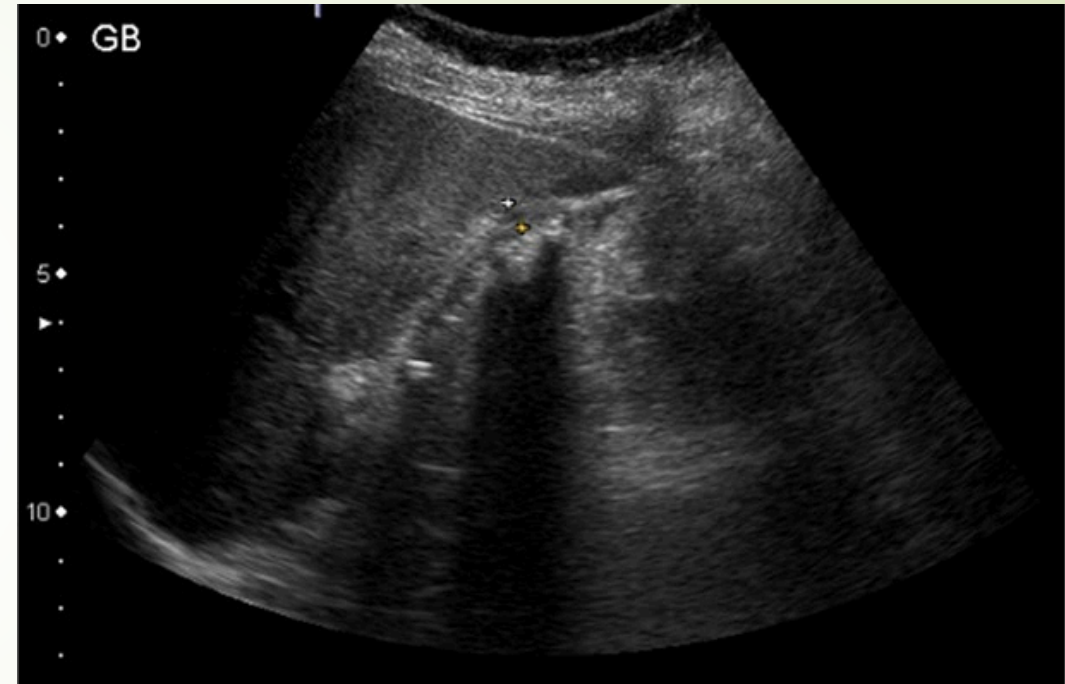
CBD often widens post cholecystectomy up to 10mm.



Longitudinal contracted gallbladder with posterior shadowing which may be from stones or from gas within the adjacent duodenum

Patient must be fasted and avoid milky drinks for 6 hours prior to the examination.

If it is still not seen, despite fasting the patient may have chronic contraction of the gallbladder, possibly due to chronic cholecystitis.



Longitudinal gallbladder partially filled with homogeneous low level echoes due to biliary stasis, represents biliary sludge or microlithiasis. Mixture of bile and bile crystals, often seen in patients with critical illness and prolonged fasting.

Biliary sludge is insignificant and usually asymptomatic but if may lead to stone formation, biliary colic, acalculous cholecystitis or pancreatitis.

Sometimes, the particulate matter in the gallbladder may be related to pus from infection or blood from trauma, presenting clinical symptoms will be different.



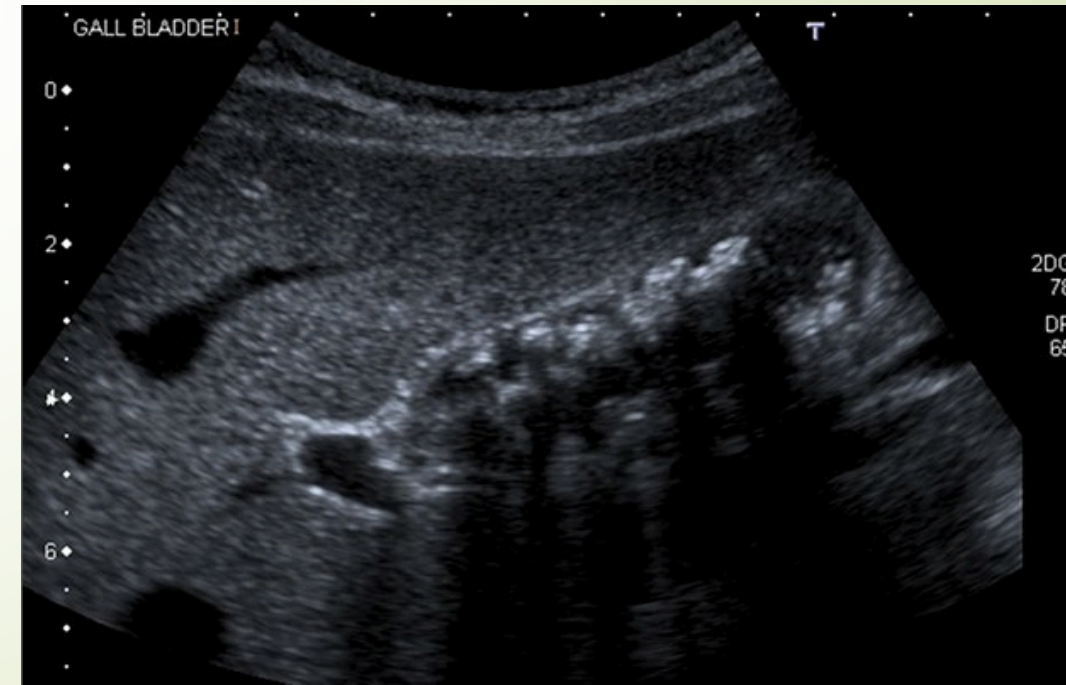
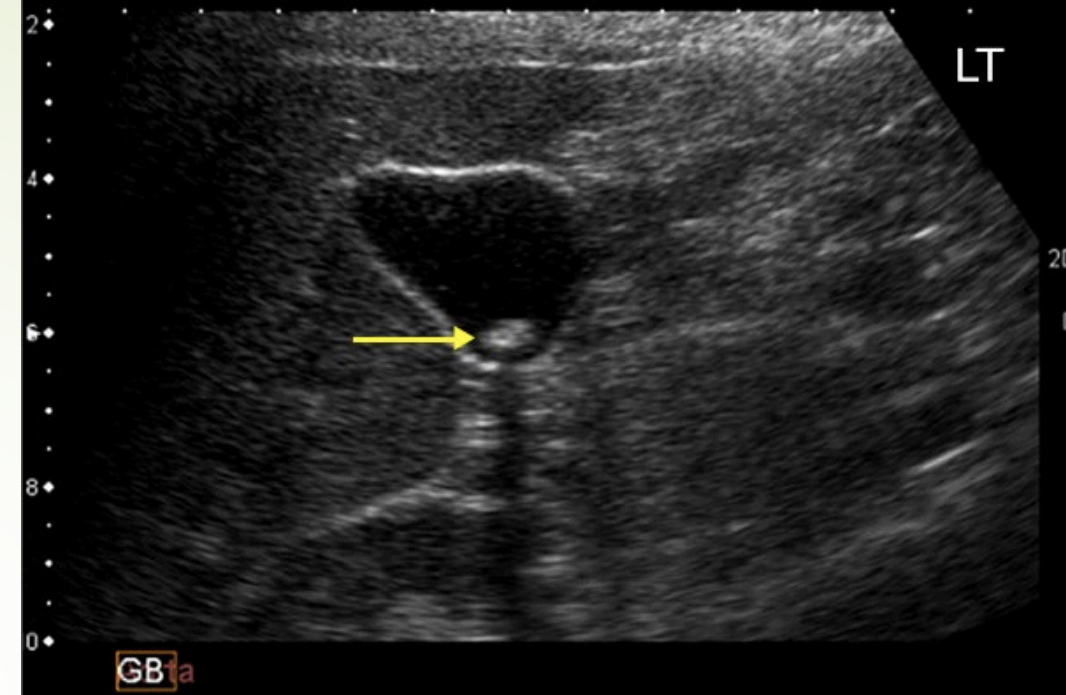
Gallstones

- more prevalent in females
- increased age
- pregnancy
- diabetes
- obesity
- may be asymptomatic
- 1 in 5 may develop complications

Risk of acute cholecystitis or other serious complications of biliary colic is about 1-2% per year.

Image 1 -transverse gallbladder with a small stone

Image 2 -longitudinal gallbladder packed with stones



Longitudinal gallbladder with single stone

May be as small as a grain of sand or as large as a golf ball.

Unlike x-rays, ultrasound appearances are the same regardless of the composition of the stone.

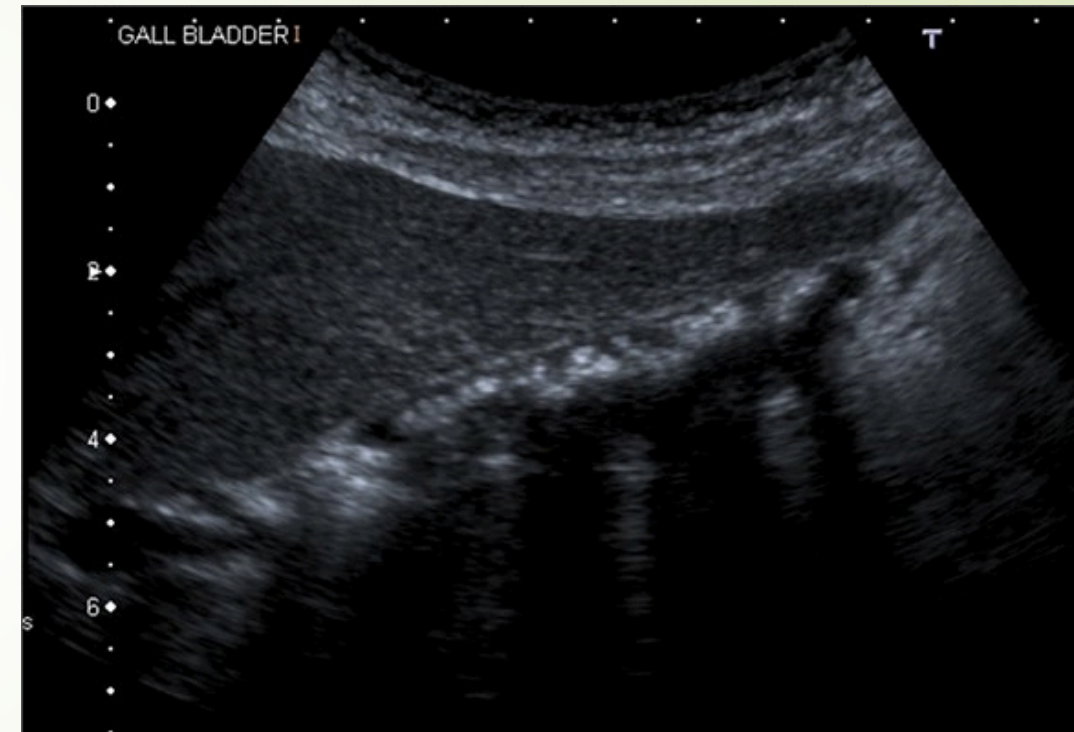
Important to scan the patient in multiple positions to determine if stones are mobile



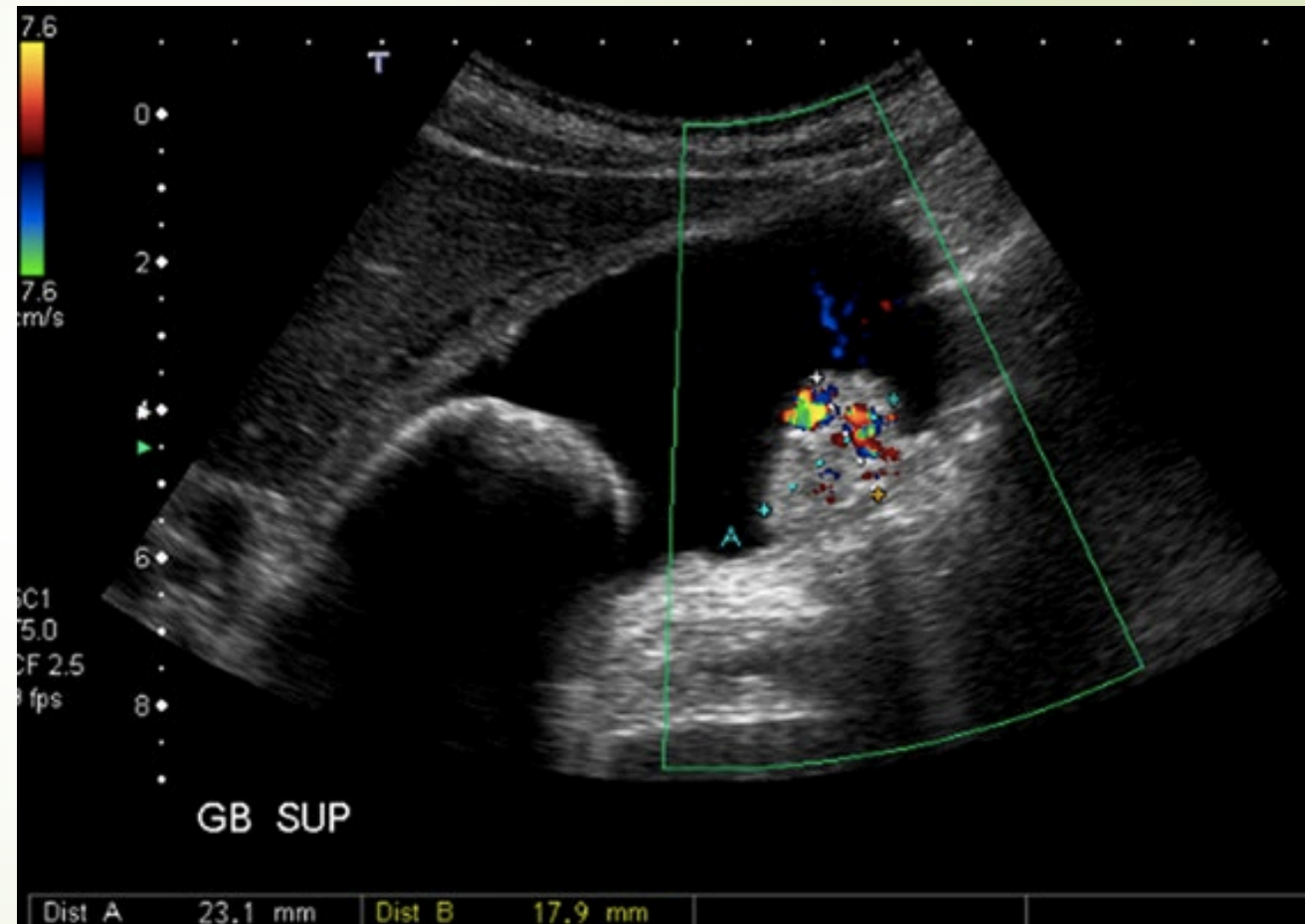
Longitudinal gallbladder with multiple shadowing calculi

Stones of less than 5mm may not shadow and may be confused with gallbladder wall polyps, turning the patient to observe movement of free stones aids in diagnosis.

Colour doppler may produce a twinkle artefact in the stone.



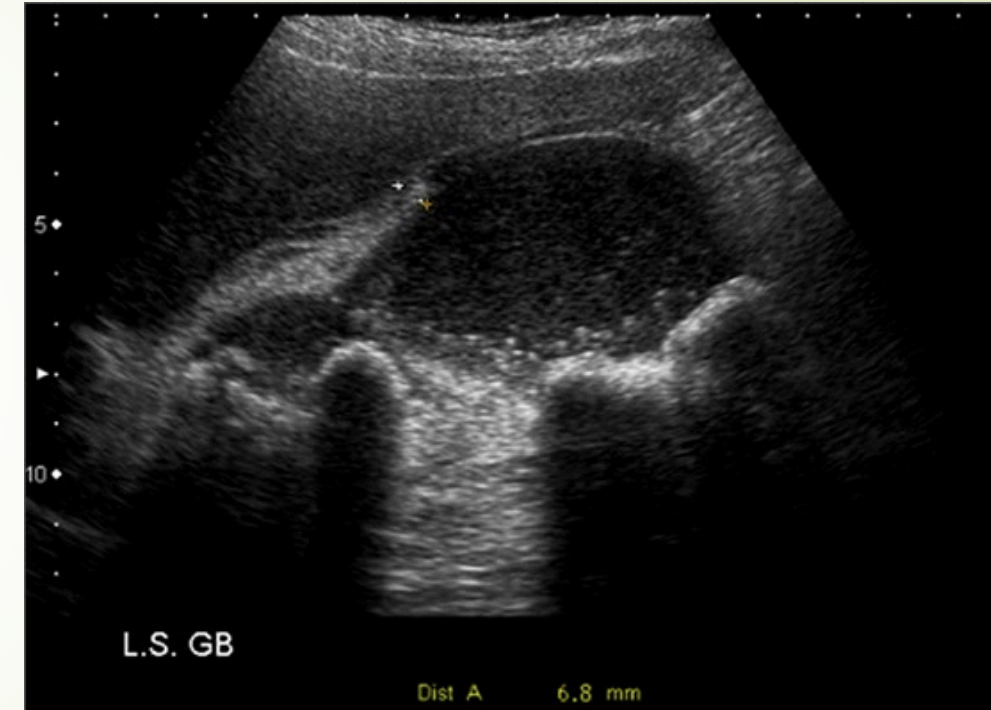
Longitudinal gallbladder with a large shadowing stone, a vascular polyp and a thickened gallbladder wall.



Acute cholecystitis

- most common disease caused by gallstones
- can occur in the absence of stones (acalculous cholecystitis)
- gallbladder wall thickened, edematous and inflamed
- infection may be present
- patient is particularly sensitive to pressure over the RUQ, known as a positive Murphy's sign.
- patients present with persistent RUQ pain, fever, leukocytosis and increased alkaline phosphatase (ALP) and bilirubin levels.

Longitudinal gallbladder with thickened edematous wall and multiple stones. This patient had acute cholecystitis.



Gallbladder wall thickening

- alone is not indicative of acute cholecystitis
- can occur for various reasons
- can be present with ascites
- continuous ambulatory peritoneal dialysis (CAPD)
- nutritional deficiencies
- chronic gallbladder disease

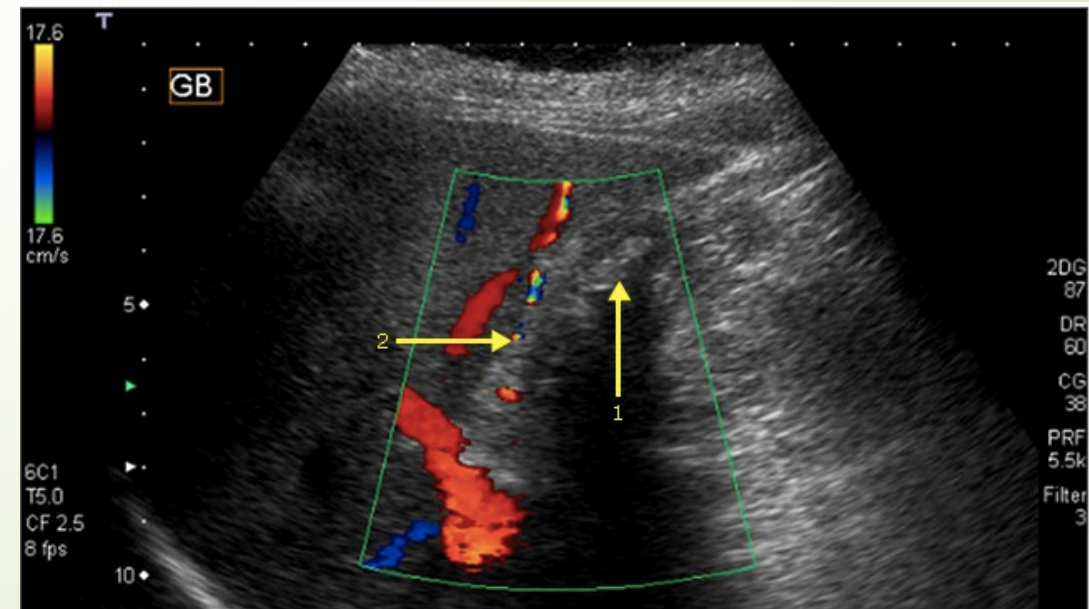
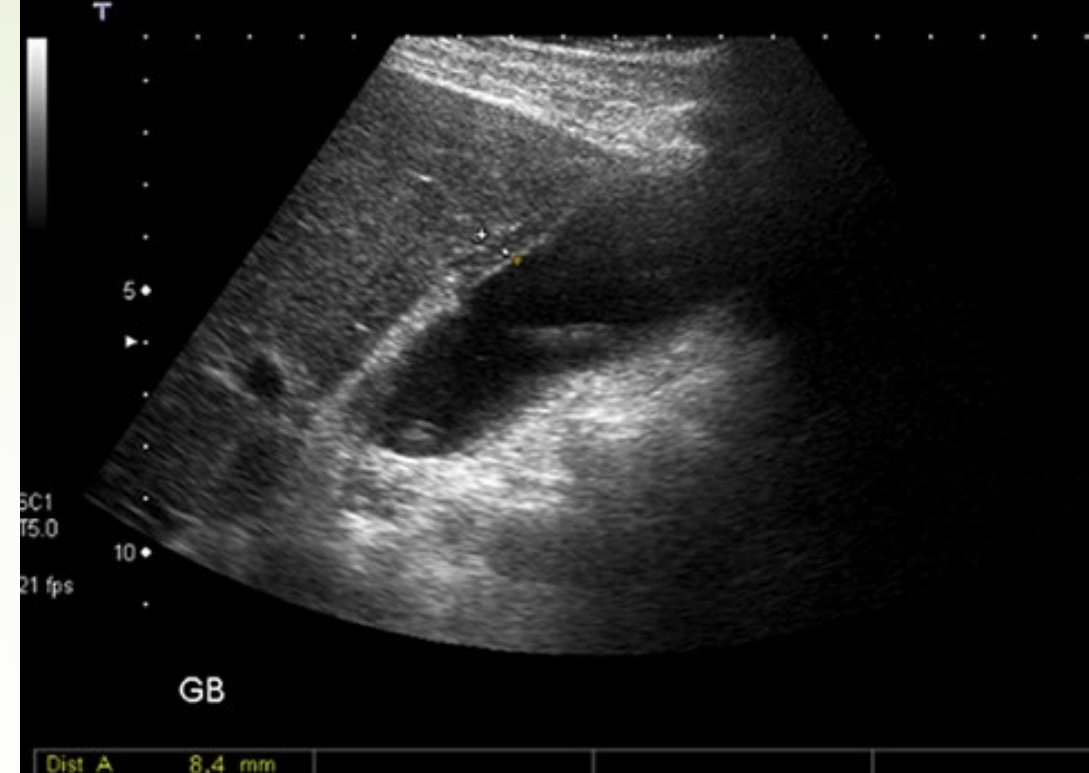
Longitudinal gallbladder with thickened wall due to ascites.



Longitudinal contracted gallbladder with stones and hypervolemic flow in the cystic artery.

Signs of acute cholecystitis may include:

- Stones within the gallbladder and possibly in the neck or cystic duct
- Thickening of the walls with some pockets of edema
- Sonographically positive Murphy's sign
- Hyperemia of the gallbladder wall
- Biliary sludge



20% of people with gallstones develop complications.

Gallbladder walls can be thickened for various reasons and therefore is not specific to diagnose acute cholecystitis.

Tenderness over the gallbladder, particularly in the presence of gallstones is a good indicator of acute cholecystitis.

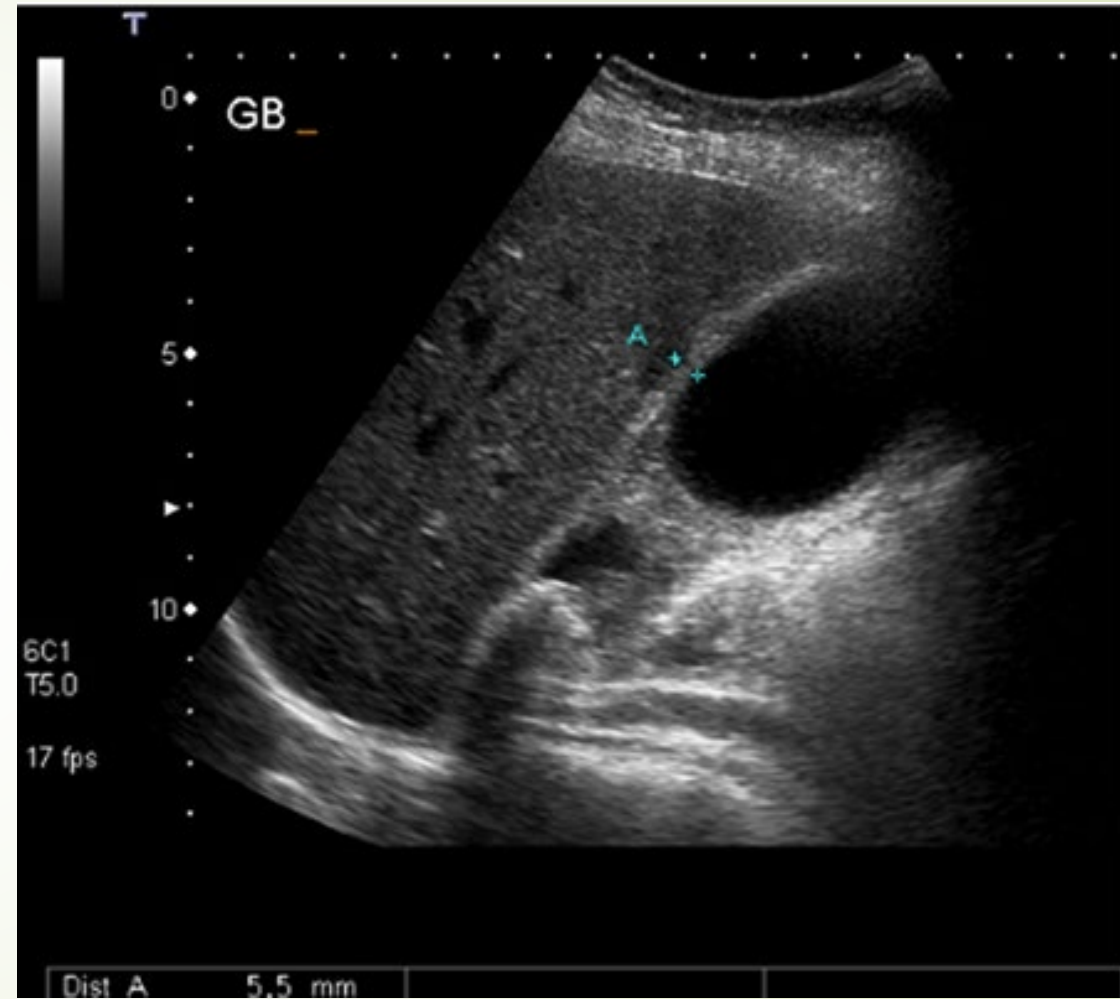
Transverse gallbladder most likely represents acute cholecystitis.



Chronic cholecystitis sonographic findings are similar:

- very thickened walls
- positive Murphy's sign
- gallbladder distention
- hyperemia of the wall.

Longitudinal gallbladder with thickened walls, a stone and focal thickening of the body. The gallbladder was non-tender on examination.



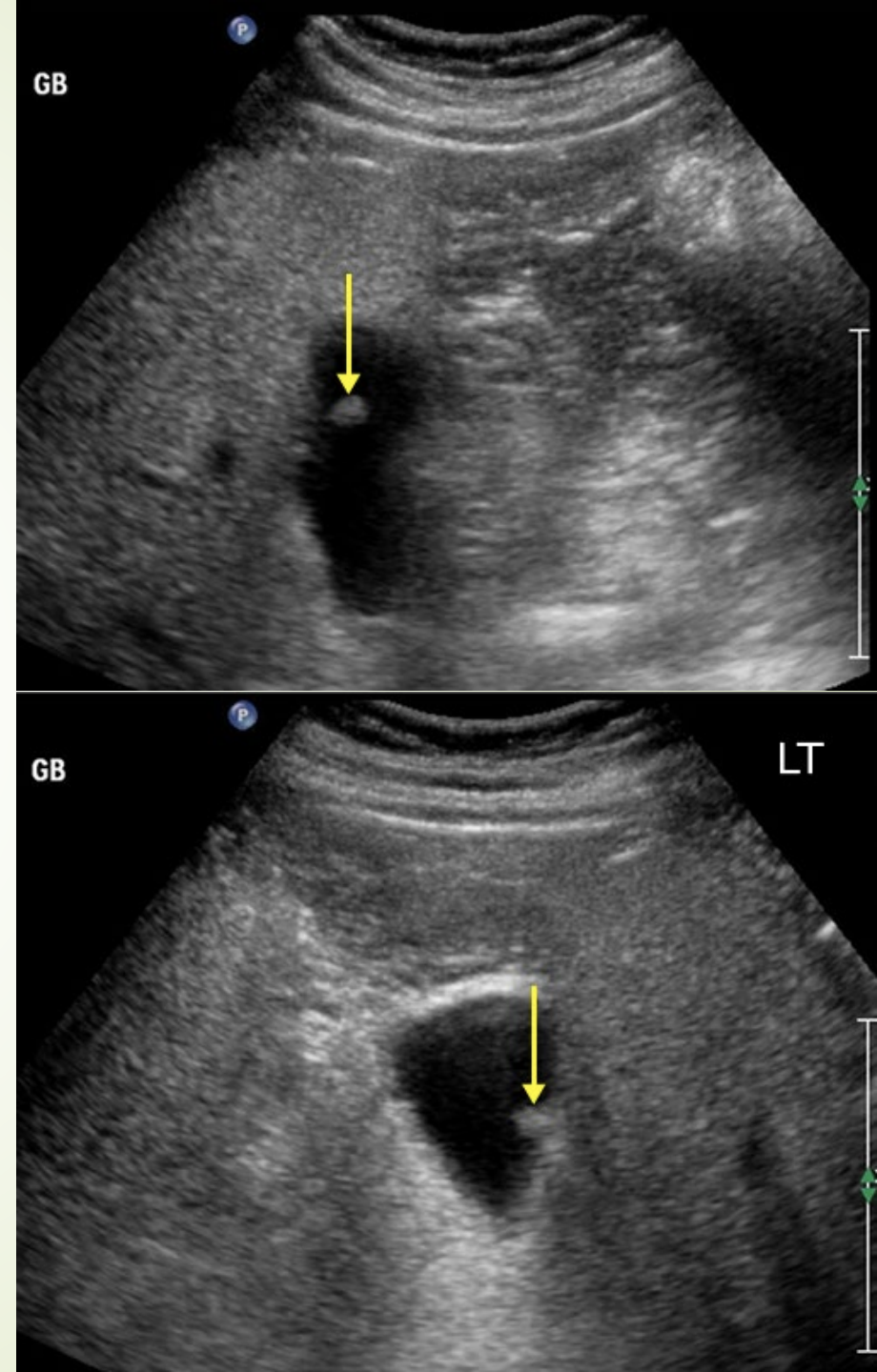
Gallbladder Polyps

- relatively common
- do not cast an acoustic shadow
- adherent to the gallbladder wall
- <10mm are most frequently benign

More likely to undergo malignant change

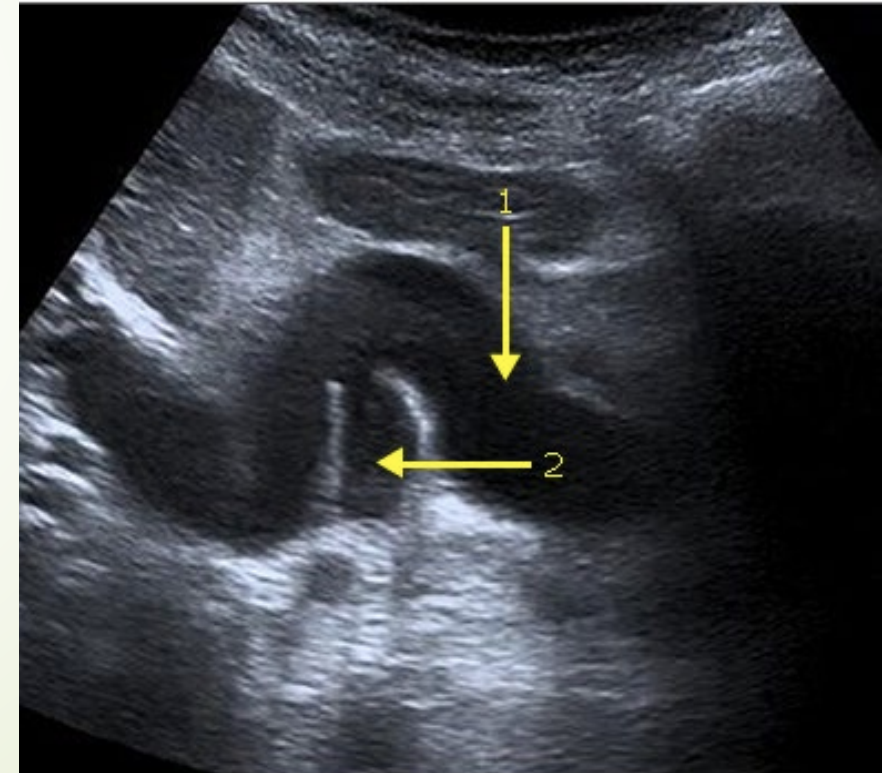
- >10mm
- patient being over 60
- associated gallstone disease
- rapid increase in size
- sessile rather than pedunculated shape

Longitudinal and transverse gallbladder with a small polyp adherent to the wall. The polyp does not move when turning the patient.



Biliary Duct Dilatation

- most common biliary tree pathology
- within the liver, there will be many more vessels than normal giving the appearance of too many tubes
- extrahepatic dilatation, CBD greater than normal for the patient's age and status (post cholecystectomy)
- painful jaundice is most likely caused by acute obstruction (usually with stone disease) or infection
- painless jaundice is usually chronic disease. Painless obstructive jaundice, in the absence of gallstones, raises a high suspicion of malignancy until proven otherwise.



Long section of a dilated common bile duct (arrow 1) with dilatation of the stump of the cystic duct (arrow 2) post cholecystectomy

Choledocholithiasis (stones within the bile ducts)

- can be primary i.e. stones formed in the duct

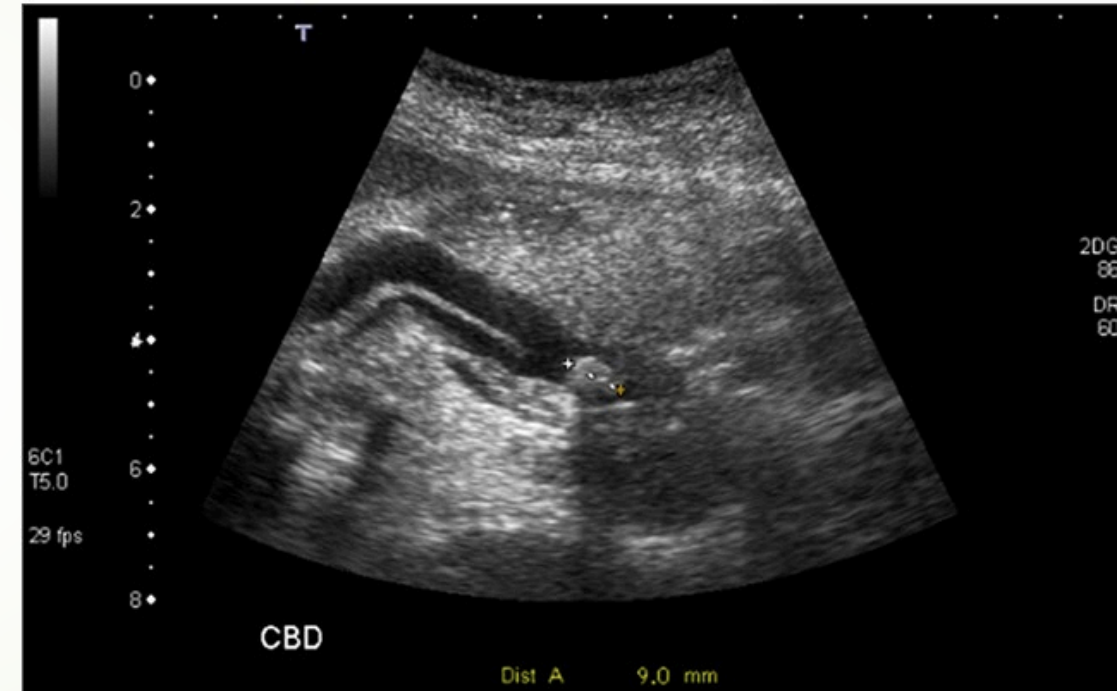
- more commonly secondary, migration of stones from the gallbladder into the CBD

- found in up to 18% of patients with gallstone disease

- common in the elderly

Classic appearance is dilated CBD with a rounded hyperechoic lesion with posterior acoustic shadowing

Surgical clips on the low insertion of the cystic duct post cholecystectomy can give a similar appearance

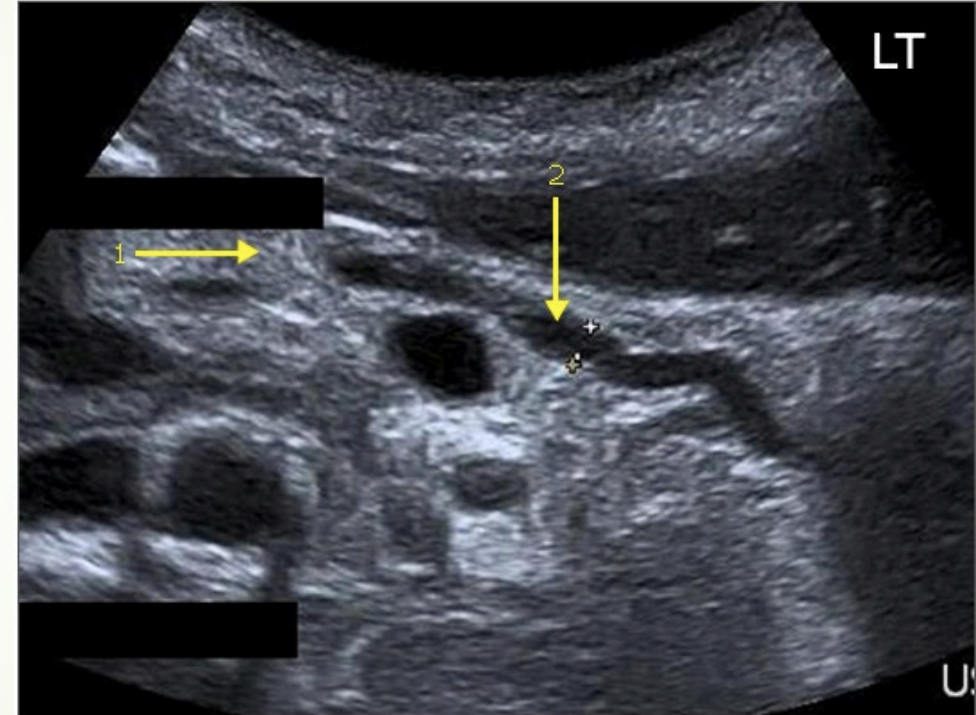


Stones within the distal CBD may cause pancreatic duct dilatation.

Pancreatic head pathology, such as a malignant mass can also cause obstruction.

Reminder: malignant obstructive jaundice is most commonly painless whereas stone disease hurts.

Image 1 - transverse view of the pancreas showing a dilated pancreatic duct.



Ascending cholangitis is a medical emergency, 85% of cases with biliary duct stones

Common symptoms are fever, RUQ pain and jaundice

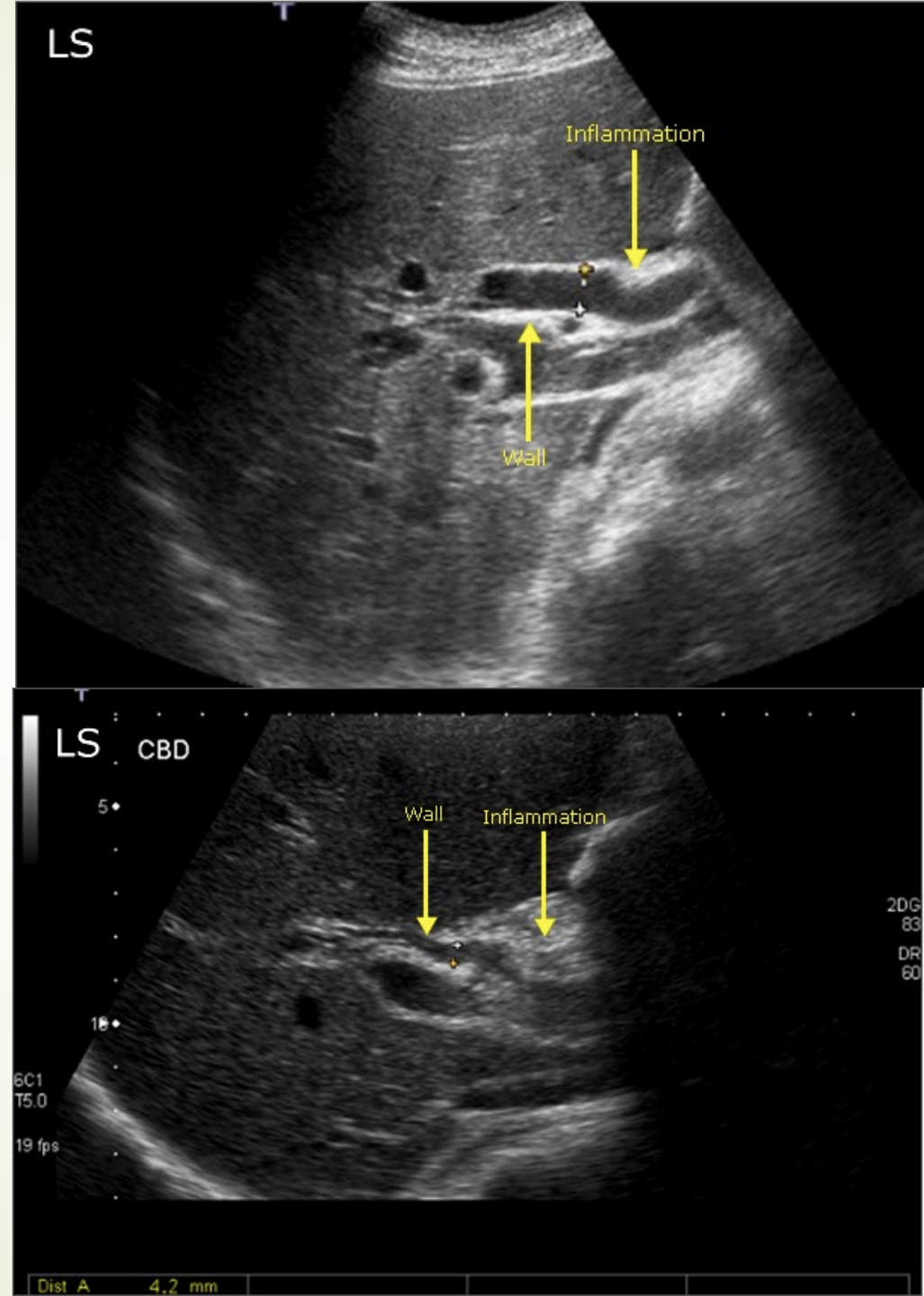
Ultrasound used to determine cause and level of obstruction.

Sonographic findings include:

- Biliary dilatation
- Choledocholithiasis and possible sludge
- Bile duct wall thickening
- Possible liver abscess

Common hepatic ducts with thickened walls and surrounding tissue is increased echogenicity consistent with inflammation.

Other causes of obstruction include biliary strictures from surgery or trauma, congenital abnormalities, and obstructive tumours.



Gallbladder sludge may be thick and solid-looking, may mimic tumour as it has the same echogenicity as soft tissue.

Longitudinal overdistended gallbladder with a large quantity sludge

To avoid misdiagnosis:

- On low velocity colour doppler there will be no evidence of vascularity
- Turning the patient will cause the sludge to move and change shape, albeit slowly



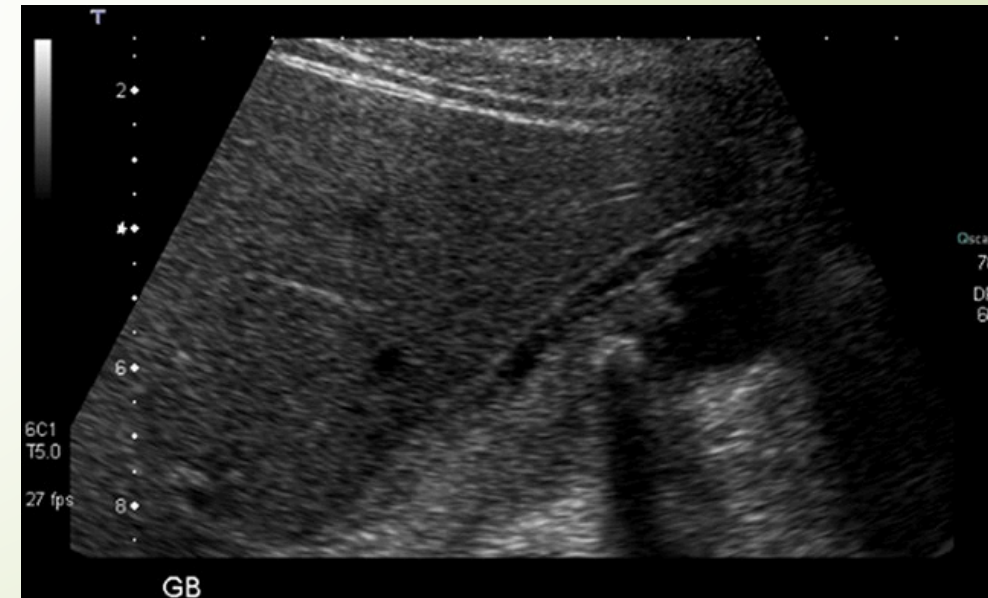
Acute on chronic cholecystitis is not uncommon. Inflammation of an already scarred gallbladder wall can lead to perforation, particularly near stones. Pericholecystic edema or fluid can be present.

This can look like wall edema caused by acute cholecystitis. Careful interrogation of the liver edge will aid visualization of free fluid in the RUQ from any gallbladder perforation.

Image 1 -longitudinal gallbladder with sludge and a stone in the neck, surrounded by free fluid.

Image 2 -longitudinal gallbladder with stones and surrounded by fluid or wall edema.

In these cases gallbladder perforation cannot be excluded.



58 yr old female with acute RUQ pain.

Longitudinal gallbladder

Several gallstones within the tender, thick walled gallbladder, some pericholecystic edema

Appearances in keeping with acute cholecystitis.



65 yr old male
diabetic patient

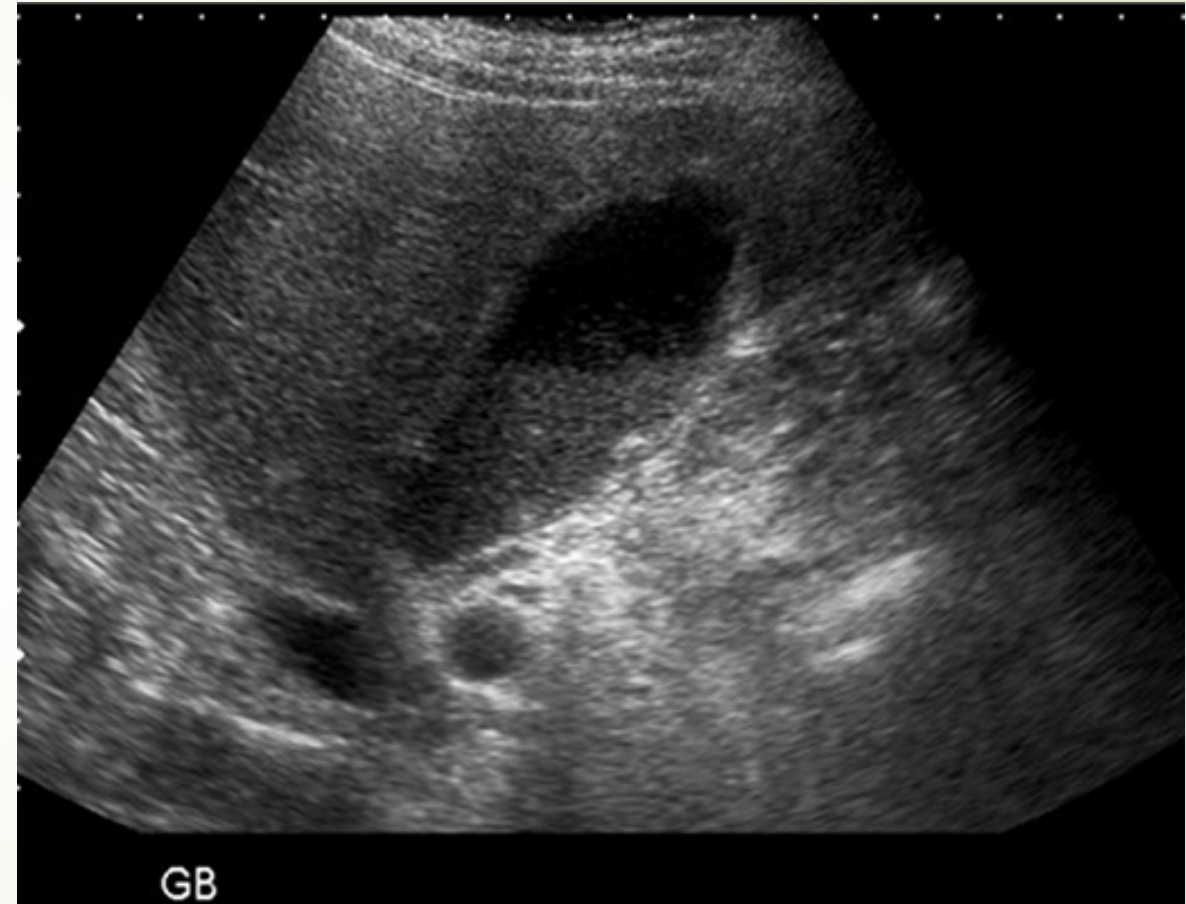
BMI 32

raised bilirubin

no pain

Longitudinal gallbladder ,biliary
sludge, walls are mildly thickened
and irregular, non-tender and not
distended.

Appearances may be in keeping
with biliary stasis.



Longitudinal common bile duct, dilated and some irregularity in the distal duct, some posterior acoustic shadowing.

Appearances of a collection of stones or sludge within the distal CBD, choledocholithiasis.





Summary



- Ultrasound is the primary imaging tool of choice for evaluating the gallbladder and biliary tree
- Knowledge of the patient's clinical history and presentation is essential before commencing the examination
- Palpation and physical examination with the transducer during the examination is important. Pain can aid the diagnosis
- Biliary tree pathology cannot always be well-visualized by ultrasound but, when performed well, it can aid patient management and inform appropriate adjunct imaging



Thank You